investigation of the Greenland nephelene syenites and their associated rocks, describes nepheline altered to cancrinite, sodalite, analcite, hydronephelene, natrolite, and potash mica; also sodalite altered to analcite and natrolite and eudialite altered to katapleite and zircon. Besides numerous varieties of feldspar, augite and hornblende, he describes Ainigmatite and Kölbingite from these rocks. The work is printed in the Danish language.

WM. H. HOBBS.

GEOLOGY AND PALEONTOLOGY.

The Protolenus Fauna.—An important paper based on the collections made by W. D. Matthews, of fossils from the lower part of the Cambrian rocks of New Brunswick in 1892, '93 and '94, was recently communicated to the New York Academy of Sciences by G. F. Matthews. From this article the following abstract has been made of the character of the fauna and the conclusions arrived at from its study.

The fauna described is one of the oldest known. It consists of Foraminifera, Sponges, Molluscs and Crustaceans. All the Foraminifera described are referred to the genera Orbulina and Globigerina; the Sponges include Protospongia and others. The Molluscs are mostly hyalithoid shells of the genera Orthotheca, Hyolithus and Diplotheca. The Crustaceans are chiefly of the two groups, Ostracoda and Trilobita, of which the former are remarkable for the large number of genera and species, as compared with the trilobites; two predominant and characteristic genera are Hipponicharion and Beyrichona. All the trilobites are of genera peculiar to this fauna, except Ellipsocephalus, which, although one of the dominating types, also occurs in the Paradoxides beds of Europe. The most characteristic genus of trilobites is Protolenus, which is abundantly present in the typical beds.

The following are some of the salient characters of the fauna as at present known: *All the trilobites have continuous eye-lobes.* This is decidedly a primitive character, and its value in this respect is shown by the genus Paradoxides of the overlying fauna, which began with small species having such eye-lobes, and culminated in the large forms of the upper Paradoxides beds in which the eye-lobe was considerably shortened.

The important family of Ptychopariidae is absent.

The genus Conocoryphe is absent. This is specially a type of the Lower Paradoxides beds, and under the name of *Conocoryphe trilineata* (*Atops trilineatus*) is claimed as a characteristic fossil of the Olenellus Zone.

The genus Microdiscus is absent. This trilobite is especially characteristic of the Olenellus Zone, and continued to live with Paradoxides.

The genus Olenellus is absent. Hence, although this fauna apparently holds the place where we might naturally expect to find Olenellus, that genus proves to be absent, or, at least, not at all characteristic; and, as so many of its associate genera also are absent, *we cannot regard this fauna as the fauna of Olenellus.*

In this fauna there is a very primitive assemblage of Brachiopods and at least one pelagic mollusc, having a helicoid shell and supposed to be free swimming Heteropod.

The author distinguishes this fauna from that of Olenellus by two marked features; it is more *primitive* and also more *pelagic.* The former is shown by the trilobite forms, and the latter by the following facts: The absence of forms differentiated for shore-conditions; trilobites with fixed outer cheeks are absent; calcareous corals and sponges are rare; thick shelled Brachiopods and Orthidae are rare: no Lamellibranch is known, but Foraminifera are common in some of the beds. (Science, April, 1895.)

Formation of Oolite.—In view of Dr. Rothpletz's recent investigations concerning the lime-secreting fission-algae of the Great Salt Lake, and his own studies of the structure of the Jurassic Pisolite, Mr. Wethered offers the following explanation of the formation of Oolitic granules:

Minute fragments of remains of calcareous organisms, such as corals, polyzoa, foraminifera, crinoids, etc., collected on the floor of the sea. These became nuclei to which the oolite-forming organisms attached themselves, gradually building up a crust. Sometimes this growth was concentric, sometimes at right-angles to the nucleus, or the two combined. When the growth was concentric, other tubules frequently cropped up in other directions and crossed the concentric tubules. At the same time, calcareous material was secreted, and the interstitial spaces between the tubules were filled.

The oolite-forming organisms may be allied to the algae, or they may be even lower in the scale of life. *Girvanella*, identified by the author in the Jurassic Pisolite, the first type of oolite-forming organism discovered, is simply a tubule. (Quart. Journ. Geol. Soc., 1895.)

The Extinction of Saurians.—In regard to the extinction of species, Mr. Charles Morris offers as an explanation of the disappearance of the Cretaceous reptiles, an indirect assault by the placental mammals, viz.: the destruction of the eggs, and possibly of the young, of the reptiles. The author points out that the mammals, equipped with a higher grade of intelligence than their powerful rivals, probably adopted new methods of attack more rapidly than the reptiles acquired means of defense, so that the latter eventually found themselves at a disadvantage in the competition for supremacy. Multitudes of prowling creatures, small and agile, having become aware of usefulness of reptiles' eggs for food, would soon bring about a perceptible diminution of reptilian life. Only the smaller and most prolific forms would continue to exist, or those that developed means of hiding or otherwise protecting their eggs from the assaults of the hungry mammals. (Proceeds. Phila. Acad., 1895.)

The Geology of Cuba.—The following geological history of Cuba is given by Mr. Robert T. Hill. The conclusions are based on stratigraphic and paleontologic data obtained during a personal recognoissance made in 1894.

1. In Pre-Tertiary times, an old land existed, almost as extensive in area as the present lsland. Whether this old land was insular, multi-insular, or connected with other Antillean areas on the mainland, I will not speculate. The submarine topography indicates that it was not. Its composition and structure, however, show that it was an area of active vulcanism accompanied by great metamorphism and eruptive flows. If there are preserved in it any traces of Pre-Tertiary sedimentation, they are largely overwhelmed and almost obliterated by the vulcanism, metamorphism and later erosion. Paleozoic, Triassic Jurassic and Cretaceous sediments have been reported by De Castro in localities, but their physical history is unknown.

2. It is also certain that during Tertiary times, embracing the Eocene and Neocene periods, this ancient nuclear land, with all of its geographic outlines, completely subsided beneath sea-level, and that it was covered with limestone sediments, which were originally derived from the sea, not the island itself, for there is no semblance of limestone material in the rocks of the Pre-Tertiary land which could have furnished material for the Tertiary rocks. That this subsidence was profound we may reasonably conclude from the thickness of the older nucleal region, now visibly covered by the limestone beds, which have been horizontally elevated to a height of at least two thousand feet. In other words, the

Pre-Tertiary subsidence may have been at least to an equal depth. During this epoch of Tertiary subsidence, a thousand feet of Tertiary limestone were accumulated over the old nucleal island.

3. After the close of Tertiary times, the Tertiary sediments were greatly warped and folded, concurrently with an emergence of the land from the sea. This movement was orogenic.

4. Following this began the epoch of epeirogenic or regional elevation. During Pleistocene time the island underwent the first of these upward impulses to its present height, with the exception of about six hundred feet represented in still later movement. This older Pleistocene or Yunque elevation raised the main area to a height of at least two thousand feet in its eastern half, and fifteen hundred feet in its western half. How much higher it extended we cannot tell, so great has been the erosion. This elevation was so rapid and general throughout the island that no coastal accumulations are preserved around its perimeter. This elevation likewise developed the present outline of the island almost in its entirety, and perhaps in greater area, which has since been destroyed by erosion.

5. Following this older and greater Post-Tertiary elevation, and intervening between it and the time of the Cuchilla, or five hundred foot level, there was a long period of erosion, cutting down the country to the Cuchilla plain, which was at that time marine base level.

6. Renewed and general elevation of the island commenced in recent times, after the period of rest recorded in the Cuchilla level. The later terraces, sea cliffs, base levels and modern coral reefs and savanna deposits of the south coast were then elevated. It is also evident that in this later period, elevation was intermittent, accompanied by slight pauses. It is difficult to exactly fix the time of this latest elevation. It was certainly very recent, and a considerable period later than the old Yunque elevation. It cannot be older than the late Pliocene, and it may or may not be in progress at present. (Bull. Harvard Mus. Comp. Zool., Vol., XVI, 1895.)

Former Altitude of Greenland.—Recent glacial studies in Greenland was chosen for the subject of the annual address of the Geological Society of America, delivered by the President, T. C. Chamberlin. In his closing remarks, the speaker referred to the former altitude of Greenland as follows:

"There is no ground to question the former elevation of Greenland. Its plateaus, like its valleys, indicate this; but glacialists are especially concerned to know whether the former elevation of Greenland was

coincident with its glaciation or not. Aside from the contours of the plateaus and valleys, which seem to indicate a fashioning rather by meteoric agencies than by pronounced glaciation, the driftless area appears to afford the most specific ground for induction. Bearing in mind that this is a small area between the present edge of the ice and sea-level, which would be overridden easily and completely by an advance of the ice-edge of less than five miles, it seems necessary to conclude that at the time of the former greater elevation the climatic agencies of glaciation could not have been what they are now, but for the increased elevation would have caused an extension sufficient to overwhelm the driftless area. If it is safe to conclude that elevation favors glaciation, then it is necessary to conclude that during any period of previous glaciation, there was here no elevation sufficient to cause an advance, unless accompanied by counteracting adverse climatic conditions. The ruggedness of Dalrymple Island bears similar testimony. The general angularity of the coastal mountains of south Greenland throw the weight of their evidence in the same direction. It would appear, therefore, that the former elevation of Greenland was not coincident with conditions favoring glaciation." (Bull. Geol. Soc. Am., Vol. 6, 1895.)

Age of the Sandstones of Crowley's Ridge.—Crowley's Ridge stretches across north-eastern Arkansas from the Missouri line to the Mississippi River at Helena. At numerous localities in this ridge a heavy deposit of cherty gravel is exposed in which are small (and rarely very large) masses of a compact, fine-grained quartzite. The gravel is undoubtedly Plistocene, and, until recently, the sandstones were supposed to be of Paleozoic age. Dr. D. D. Owen referred them to the Potsdam from their lithological character. An investigation by Mr. R. Ellsworth Call, however, results in the discovery that they are indurated sandstones of the same age, and sharing in the common history of the gravels through which they protrude. Dr. Branner has observed similar facts of metamorphosis in Brazil, and these corroborate the view suggested by Mr. Call that the metamorphism is due to weathering.

The facts ascertained by Mr. Call concerning this disputed formation are summed up as follows:

"These rocks are of limited occurrence, covering a few hundred acres all told; they are found at rather low elevation in the hills, although they sometimes occur as far as the very tops of the highest points in the ridge country; they have yielded fossils of Lower or Eocene Ter-

tiary age; they have probably resulted from weathering processes; are metamorphic in character, and have no history of dynamic origin or of present or past dynamic change. Their former reference to the palaeozoic is no longer tenable, and they stand as a unique instance of the induration of soft sandstones in the southwest." (Proceeds. Ind. Acad. Sci., Vol. III, 1893–1894.)

Geological News.—The remains of two reptiles are reported from the Triassic of Shasta Co., California, by J. C. Merriam. The larger individual is represented by eight consecutive vertebræ, a few fragments of ribs and both coracoids. These present an assemblage of characters that necessitate the creation of a new genus, *Shastasaurus* with the specific name *pacificus*. The second and smaller individual represents a very different form from that described above, but the material is insufficient for specific characterization. (Am. Journ. Sci., 1895.) The figures and description of Mr. Merriam indicate that the alleged relationship to Ichthyosaurus is very doubtful.

A fossil Liverwort is described by Mr. F. H. Knowlton from the Lower Yellowstone of Montana. The species, which represent the only extinct form from North America, is allied to the genus Preissia, and a new genus, Preissites, has been made for its reception. The fossil was found by Professor Lester Ward, to whom the species is dedicated. (Bull. Torrey Botanical Club, Oct., 1894.)

Mr. R. T. Hill records the occurrence of Radiolarian earth at Baracoa in the island of Cuba. The strata are vertical and over 500 feet in thickness. The rock is chalky in appearance, with occasional thin separation-layers of gray-blue clay, and some flint-like siliceous nodules: sponge-like spicules and echinoid fragments are found in it, but no diatoms. It appears to lie below certain yellow beds identified as Miocene, (Bull. Mus. Comp. Zool., Harvard, 1895.)

Records of well-borings in Iowa show the presence of numerous buried drainage channels. A comparison of the data indicates that in pre-glacial time the land surface of the State stood at an elevation considerably above that now obtaining. Throughout the driftless area there is evidence that the region, after being reduced to a base level of erosion, has been elevated, and is now being reduced to a second base level. (Proceeds. Iowa Acad. Sci., Vol. II, 1895.)

Captain F. W. Hutton publishes a classification of the genera of the Dinornithidæ, based on the characters of the axial skeleton, and, in the absence of illustrations, gives keys to assist in distinguishing the genera. (Trans. New Zealand Inst., 1894.)